

**What is claimed is:**

- [Claim 1] A material application system comprising:  
a dense phase pump having an output connectable to a material inlet of a  
material applicator;  
said material applicator comprising a feed tube from an inlet end to an outlet  
end; and  
an air cap at an outlet end of the applicator for directing air at a flow of  
material exiting the applicator outlet end.
- [Claim 2] The system of claim 1 comprising a supply hose that connects  
said pump outlet to said applicator inlet, said hose having a substantially  
similar inner diameter as said feed tube.
- [Claim 3] The system of claim 1 comprising a supply hose that connects  
said pump outlet to said applicator inlet, said feed tube and said supply hose  
defining a material flow path therethrough that has a substantially constant  
geometry from said pump outlet to said applicator outlet end.
- [Claim 4] The system of claim 1 comprising a material supply in the form of  
a duct having one end connectable to a material recovery system and closed at  
an opposite end by a fluidizing bed.
- [Claim 5] The system of claim 4 comprising a siphon ring disposed above  
said fluidizing bed, said ring having at least one suction port in fluid  
communication with an inlet to said pump, said port being open to a fluidizing  
zone within said siphon ring.
- [Claim 6] The system of claim 4 wherein the pump comprises a purge  
function wherein purge air passes through the entire material flow path within  
said pump and through a supply hose that connects the pump to the  
applicator, and through said feed tube in the applicator.
- [Claim 7] The system of claim 4 wherein the pump comprises a purge  
function wherein purge air passes through the entire material flow path within

the pump and back through a feed hose to the material supply, thereby reverse purging the pump and supply.

[Claim 8] The system of claim 4 wherein the pump comprises a purge function wherein purge air passes through a material flow path from the pump through the applicator, and through a material flow path from the pump back to the supply.

[Claim 9] The system of claim 8 wherein the pump comprises pneumatic pinch valves that form part of the material flow paths for material provided to the applicator and material received from the supply, said pinch valves being separately controlled so that the powder flow paths can be purged in a selectable manner.

[Claim 10] In a material application system of the type including a pump and a spray gun, the improvement comprising:

the pump being a dense phase pump, the spray gun having an uninterrupted material flow path therethrough from an inlet to an outlet, an air cap at the gun outlet to apply a flow of air to material exiting said outlet, and a control circuit for adjusting the flow of pattern air from said air cap to adjust a spray pattern of material from the gun.

[Claim 11] The system of claim 10 wherein said control circuit adjusts material flow rate to the gun in response to changes in said pattern air flow.

[Claim 12] The system of claim 11 wherein said control circuit reduces material flow in response to an increase in said pattern air flow.

[Claim 13] The system of claim 10 wherein said gun comprises a pattern adjust trigger that can be manually actuated by an operator while the operator observes changes to the spray pattern; wherein actuation of said trigger changes the pattern air flow to said air cap.

[Claim 14] The system of claim 13 wherein the operator can save air flow and material flow rates for later use in spraying similar parts using the same spray recipe.

[Claim 15] The system of claim 13 wherein the pattern air flow is adjusted in a ramping manner.

[Claim 16] The system of claim 13 wherein the pattern air flow is adjusted in a step wise manner.

[Claim 17] A material application system comprising:

a dense phase pump having an output connectable to a material inlet of a material applicator;

said material applicator comprising a feed tube from an inlet end to an outlet end;

a spray booth and a material overspray recovery system for removing material overspray from the booth,

a supply of material, said supply comprising a duct that is connectable to said recovery system and a fluidizing bed, wherein material flows from said duct through said pump and applicator completely in a dense phase.

[Claim 18] The system of claim 17 wherein said supply is in fluid communication with said recovery system for a cleaning mode and is substantially disconnected from said recovery system for a supply mode.

[Claim 19] The system of claim 17 wherein the pump sucks fluidized powder from said duct.

[Claim 20] A particulate material application system comprising:

an applicator pump having a pump chamber, a source of negative air pressure connectable to said pump chamber to draw particulate material into said pump chamber, and a source of positive air pressure connectable to said pump chamber to discharge particulate material from said pump chamber, said pump having an outlet;

a particulate material applicator having a material inlet which is connected to said outlet of said applicator pump, said material applicator having an outlet; and

an air cap being positioned at said outlet for directing air at a flow of particulate material exiting said applicator outlet.

[Claim 21] The system of claim 20 wherein said material applicator has a feed tube which extends from said applicator inlet to said applicator outlet.

[Claim 22] The system of claim 21 comprising a supply hose that connects said applicator pump outlet to said applicator inlet, said hose having a substantially the same inner diameter as said feed tube.

[Claim 23] The system of claim 21 comprising a supply hose that connects said applicator pump outlet to said applicator inlet, said feed tube and said supply hose defining a material flow path therethrough that has a substantially constant geometry from said applicator pump outlet to said applicator outlet.

[Claim 24] The system of claim 20 wherein said applicator pump has an inlet and wherein said inlet of said applicator pump is connected to a particulate material supply having a supply chamber, said supply chamber having a bottom, a fluidizing plate being located adjacent said bottom of said supply chamber, said fluidizing plate being removably attached to said supply chamber.

[Claim 25] The system of claim 24 wherein when said fluidizing plate is removed, said supply chamber is connectable to a source of negative air pressure to pull air through said bottom of said supply chamber.

[Claim 26] The system of claim 24 wherein said fluidizing plate has a cross-sectional area which is greater than the cross-sectional area of said supply chamber.

[Claim 27] The system of claim 20 wherein said applicator pump has an inlet and wherein said inlet of said applicator pump is connected to a particulate material supply having a supply chamber, said supply chamber having a removable bottom and being connectable to a source of negative air pressure to draw air up through said bottom of said supply chamber when said bottom is removed.

[Claim 28] The system of claim 20 wherein said particulate material is powder coating material and further comprising a powder coating booth

wherein powder coating material is sprayed at workpieces by said applicator and wherein oversprayed powder coating material which does not adhere to said workpieces is drawn from said booth and into a powder overspray collector by a negative air pressure source, said powder overspray collector having a container for overspray powder coating material, said oversprayed powder coating material being removed from said container by a transfer pump, said transfer pump having a pump chamber, a source of negative air pressure connectable to said pump chamber to draw said oversprayed particulate material into said pump chamber, and a source of positive air pressure connectable to said pump chamber to discharge said overspray particulate material from said pump chamber, said transfer pump having an outlet.

[Claim 29] The system of claim 28 wherein said applicator pump has an inlet and wherein said inlet of said pump is connected to a particulate material supply having a supply chamber, said outlet of said transfer pump being connected to said supply chamber.

[Claim 30] The system of claim 29 further wherein said material supply further comprises a sieve, said sieve being positioned above said supply chamber, said outlet of said transfer pump being connected above said sieve.

[Claim 31] The system of claim 29 further comprising a second transfer pump, said second transfer pump having a pump chamber, a source of negative air pressure connectable to said pump chamber to draw said virgin particulate material into said pump chamber, and a source of positive air pressure connectable to said pump chamber to discharge said virgin particulate material from said pump chamber, said transfer pump having an inlet connected to a supply of virgin powder and an outlet connected said material supply.

[Claim 32] The system of claim 31 further wherein said material supply further comprises a sieve, said sieve being positioned above said supply chamber, said outlet of said second transfer pump being connected above said sieve.

